Weir Farm National Historic Site

Geologic Resources Division
National Park Service
US Department of the Interior

The Geologic Resource Evaluation (GRE) Program provides each of 270 identified natural area National Park Service (NPS) units with a geologic scoping meeting, a digital geologic map, and a geologic resource evaluation report. Geologic scoping meetings generate an evaluation of the adequacy of existing geologic maps for resource management, provide an opportunity for discussion of park-specific geologic management issues and, if possible, include a site visit with local geologic experts. The purpose of these meetings is to identify geologic mapping coverage and needs, distinctive geologic processes and features, resource management issues, and potential monitoring and research needs. Outcomes of this scoping process are a scoping summary (this report), a digital geologic map, and a geologic resource evaluation report.

The National Park Service held a GRE scoping meeting for Weir Farm National Historic Site (WEFA) on July 9, 2007 at the University of Massachusetts, Amherst. Tim Connors (NPS-GRD) facilitated the discussion of map coverage and Bruce Heise (NPS-GRD) led the discussion regarding geologic processes and features at the national historic site. Participants at the meeting included NPS staff from the park, Northeast Region, and Geologic Resources Division, geologists from the State Geological and Natural History Survey of Connecticut, Vermont Geological Survey, and University of Massachusetts, Amherst as well as cooperators from Colorado State University (see table 1). This scoping summary highlights the GRE scoping meeting for Weir Farm including the geologic setting, the plan for providing a digital geologic map, a prioritized list of geologic resource management issues, a description of significant geologic features and processes, lists of recommendations and action items, and a record of meeting participants.

Park and Geologic Setting

Authorized on October 31, 1990, Weir Farm National Historic Site preserves 60 acres of the Southwest Hills Ecoregion in the southern portion of Connecticut within the Bethel, CT 7.5 minute quadrangle. In addition to the land within park boundaries, abutting natural areas include 110 acres of open space owned by the Weir Farm Art Center and another 80 acres of natural space owned by the town of Ridgefield. The park is part of a natural space corridor in south-central Connecticut. The historic site sits between the towns of Ridgefield and Wilton and commemorates the home of artist Julian Alden Weir. The natural landscape at the farm was an artist's haven and inspiration throughout the late 19th and 20th centuries. In addition to American impressionist Weir, sculptor Mahonri Young and painter Sperry Andrews made the farm their home beginning in 1882 until 2005. Notable features of the Weir Farm landscape include successional old fields, vernal wetland areas, streams, a manmade pond, mesic successional hardwood forests, rocky ridges, two farmsteads and associated buildings. The interrelationships between bedrock and surficial geology as well as geomorphological processes created the landscape that inspired the art work created at Weir Farm National Historic Site.

Much of the land area within park boundaries east of Nod Hill Road is within the watershed of the Norwalk River. Rolling, forested hills separated by fields, meadows, small lakes and shallow stream valleys characterize the landscape in the Weir Farm area. Notable landmarks include Nod Hill

within the park, and Branchville, Biddle, Florida, and Ivy Hills north and west of the park as well as Sunset and Honey Hills to the southeast. Exposed in the park and surrounding areas are geologic units primarily Ordovician in age. Bedrock units include gray gneiss, amphibolite, schist, granite gneiss, and younger pegmatite igneous intrusive rocks. The park lies along a boundary between gray gneiss and granite gneiss which intruded the older gray gneiss as discrete igneous dikes. Deposited atop these old bedrock units are blankets of glacial tills and outwash deposits from the Pleistocene Ice Age events. Several seasonal streams within the park cut through these surficial deposits in shallow valleys.

Geologic Mapping for Weir Farm National Historic Site

During the scoping meeting Tim Connors (NPS-GRD) showed some of the main features of the GRE Programs digital geologic maps, which reproduce all aspects of paper maps, including notes, legend, and cross sections, with the added benefit of GIS compatibility. The NPS GRE Geology-GIS Geodatabase Data Model incorporates the standards of digital map creation set for the GRE Program. Staff members digitize maps or convert digital data to the GRE digital geologic map model using ESRI ArcMap software. Final digital geologic map products include data in geodatabase, shapefile, and coverage format, layer files, FGDC-compliant metadata, and a Windows HelpFile that captures ancillary map data. Completed digital maps are available from the NPS Data Store at http://science.nature.nps.gov/nrdata/.

When possible, the GRE program provides large-scale (1:24,000) digital geologic map coverage for each park's area of interest, usually composed of the 7.5-minute quadrangles that contain park lands (figure 1). Maps of this scale (and larger) are useful to resource management because they capture most geologic features of interest and are positionally accurate within 40 feet. The process of selecting maps for park management begins with the identification of existing geologic maps and mapping needs in vicinity of the park. Scoping session participants then select appropriate source maps for the digital geologic data to be derived by GRE staff as well as determine areas in need of further mapping or refinement. Table 2 (at the end of this document) lists the source maps chosen for Weir Farm National Historic Site as well as any further action required to make these maps appropriate for inclusion in the final geologic map for the site.

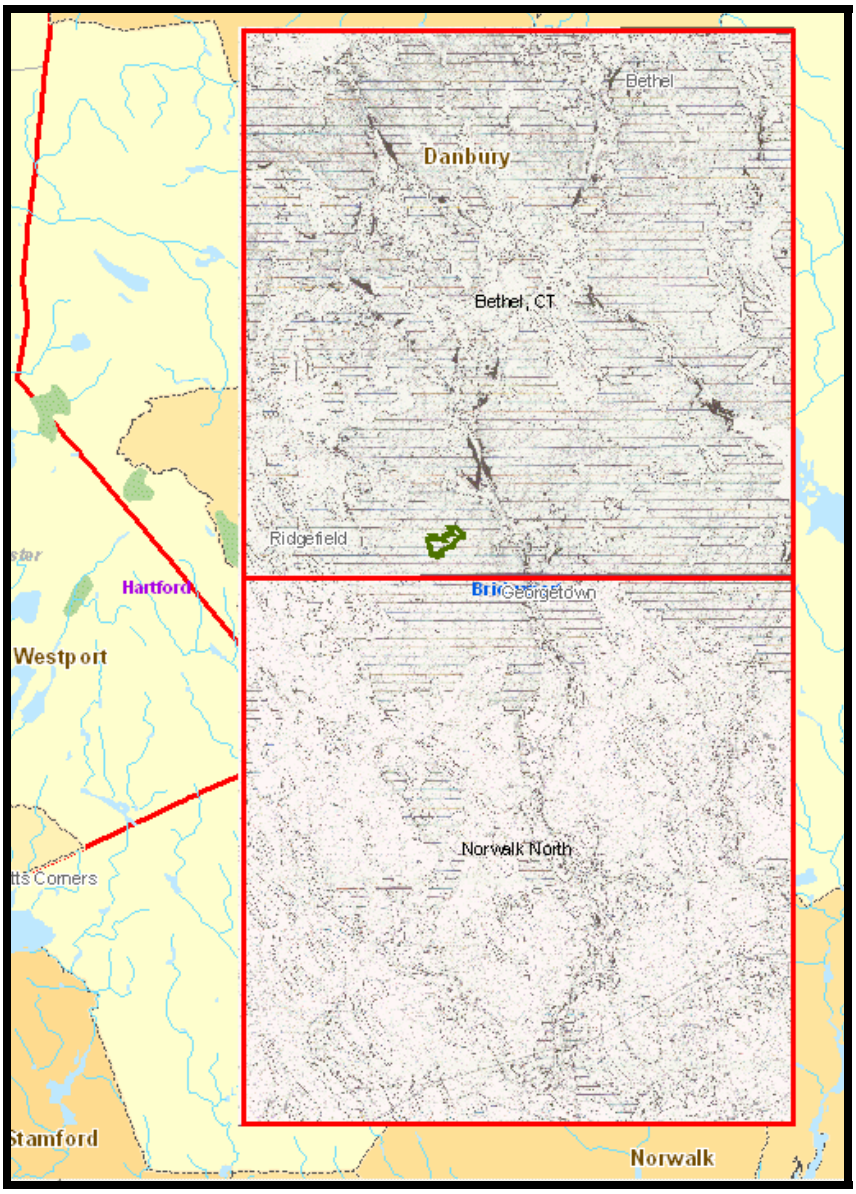

Figure 1. Quadrangles of interest for Weir Farm National Historic Site showing known large-scale surficial geologic maps (at time of scoping meeting). The figure shows USGS 7.5' quadrangles (red outline).The green outlines represent park boundaries.

Weir Farm National Historic Site expressed interest in obtaining geologic map coverage for both the Bethel, CT and adjacent Norwalk North 7.5-minute quadrangles for resource management and surficial and bedrock geologic maps would be most useful for park resource management. At present, there is adequate surficial geologic map coverage at both the 7.5’ quadrangle scale as well as in a state-wide coverage, all completed by the U.S. Geological Survey in the references below:

- (2953) London, E.H., 1984, Surficial geologic map of the Bethel quadrangle, Connecticut, USGS, Miscellaneous Field Studies Map MF-1519, 1:24000 scale

- (2954) London, E.H., 1984, Surficial geologic map of the Norwalk North quadrangle, Connecticut, USGS, Miscellaneous Field Studies Map MF-1520, 1:24000 scale

- (74348) Stone, J.R., Schafer, J.P., London, E.H., DiGiacomo-Cohen, M.L., Lewis, R.S., and Thompson, W.B., 2005, Quaternary geologic map of Connecticut and Long Island Sound Basin, USGS, Scientific Investigations Map SIM-2784, 1:125000 scale.

There is bedrock geologic map coverage for the Norwalk North quadrangle at 1:24,000-scale as follows:

(55025) Kroll, R.L., 1977, Bedrock geology of the Norwalk north quadrangle, Connecticut (plate 1/5), 15, Quadrangle Report 34 (plate 1/5), 1:24000 scale

Bedrock geologic map coverage needs persists for the Bethel, CT quadrangle. The State Geological and Natural History Survey of Connecticut suggested supporting a graduate student through connections with a professor at Indiana University (Bob Wintsch). The State Map program may also be a viable option to obtain adequate bedrock geologic map coverage for the Bethel, CT quadrangle.

As a last resort, the Connecticut state geologic bedrock map could be used to cover both quadrangles as it is already in a digital format as follows:

(2299) Rodgers, John, 1985, Bedrock geological map of Connecticut, State Geological and Natural History Survey, Connecticut Natural Resources Atlas Series, 1:125000 scale

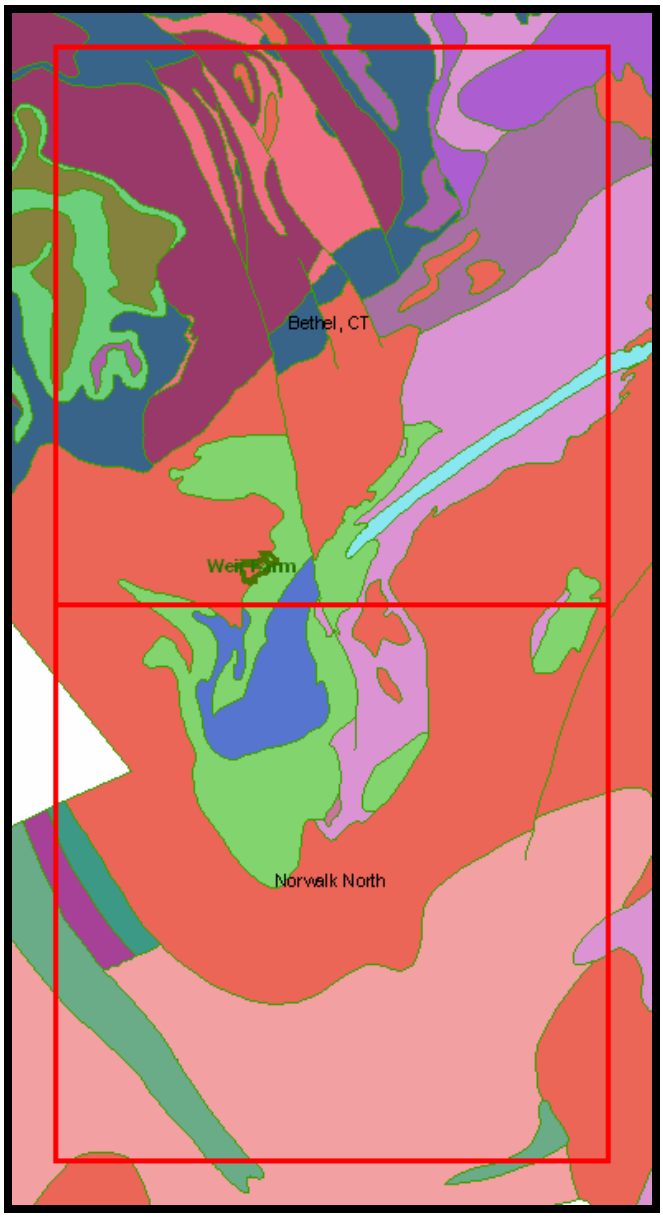

Figure 2. Footprint of GMAP 2299 (Connecticut state bedrock geologic map) in WEFA area

Table 2 lists the source maps chosen for Weir Farm National Historic Site and mapping needs in certain quadrangles, in addition to a unique "GMAP ID" number assigned to each map by GRE staff for data management purposes, map scale, and action items.

Additional items of interest pertaining to geologic mapping from the scoping

The national historic site has some interest in derivative map products including a geologic interpretive trail guide as well as maps that link landscape paintings with the natural geomorphology of the park.

Geologic Resource Management Issues

The scoping session for Weir Farm National Historic Site provided the opportunity to develop a list of geologic features and processes, which will be further explained in the final GRE report. During the meeting, participants listed the most significant geologic issues as follows:
(1) Fluvial issues
(2) Mass wasting
(3) Pond maintenance
(4) Disturbed lands and adjacent land use
(5) Seismicity

Fluvial Issues

Several seasonal streams traverse Weir Farm National Historic Site. The streams at Weir Farm are at the top of the drainage so flooding is not a significant threat to the park infrastructure. Most of the park sits in a valley bottom setting and two north-south trending wetland areas cross the property. Understanding the hydrogeologic system, especially how it pertains to surface water drainage at the historic site, would help resource managers predict potential responses to landscape change both within and adjacent to park boundaries.

Mass Wasting

Though not considered a prevalent problem, some of the steeper slopes characteristic of the rolling hills at Weir Farm National Historic Site are prone to mass wasting events such as slumps, and slope creep. Gravity, frost heave, root wedging, and erosion are primary causes of natural slope instability. Features such as dipping geologic units, undercut bedrock, deeply weathered bedrock, and natural groundwater seeps create unstable settings on steep slopes. Human activities such as landscaping, road construction, and facilities development may lead to new mass wasting and reactivation of old landslide features. Developers may cut into the toe of a slope or load the top of a slope. Diverting water into certain areas may lubricate slopes. Several trails at the site experience erosion. Trail maintenance structures are in place to counteract this natural geologic process.

Pond Maintenance

Using a $2,500 dollar award that he won from the Boston Art Club for a painting, Julian Alden Weir constructed a small fishing pond on his property by damming a small seasonal stream and wetland area. The pond is featured in many of Weir's artistic endeavors. This pond is still present at the site today thanks to the foresight of future owners Sperry and Doris Andrews. As the Wilton and Ridgefield communities slowly transitioned from farming communities to suburban residential areas, the Weir Farm area was at risk of being developed. The Andrews, over their four-decade tenure at the farm, organized a preservation movement that ultimately saved much of the landscape now incorporated into the national historic site. Today a leaking earthen dam impounds the fishing pond at the site. Dam failure would not pose a significant downstream hazard. Because the pond is now an important cultural resource at the site, resource management wants to repair the leaking dam and potentially dredge the pond to restore historic conditions.

Disturbed Lands and Adjacent Land Use

The area surrounding Weir Farm National Historic Site is attracting a population surge as people move from urban areas such as New York City to suburban spaces. Development and land use

changes adjacent to the national historic site impact park resources. Residential development prior to the arrival of the NPS created a disturbed land area, which was followed by the introduction of invasive plant species (i.e. Asiatic barberry, winged Euonymus, bittersweet, black swallowwort). GRD is working with the national historic site to remediate these impacts.

Other disturbed features in the area include old, abandoned mines located just adjacent to park boundaries. These mines were dug into pegmatite rocks looking to extract feldspar, mica, quartz, and tourmaline for industrial use.

Disturbed features within the park include an old wagon road leading to the pond from the barn. This is treated as a cultural feature at the national historic site and will not be remediated.

Seismicity

Earthquakes are not widely associated with the Weir Farm area, but small earthquake events occur along local faults. Recent seismic activity occurred at Danbury, Connecticut - 18 km (11 miles) away. Earthquakes take up tectonic stresses on basement structures deep beneath the earth's surface. Moderate seismic events could damage cultural resources at the park such as buildings, foundations, and dams. The U.S. Geological Survey maintains an earthquake-monitoring website: http://earthquake.usgs.gov/eqcenter/recenteqsus/.

Features and Processes

Glacial Features

During the Pleistocene Epoch, more than 10,000 years ago, glacial ice sheets descended from the north over the Weir Farm area, burying the existing landscape. Glaciers are effective agents of erosion, beveling hills and other topographic highs while transporting vast amounts of sediments picked up en route. When the glacial ice melts and retreats, these sediments remain and may cover the underlying landscape. If glacial retreat is rapid, the sediments once entrained in the glacial ice are relatively unsorted and contain fragments of various sizes ranging from the smallest clay to boulders. Outwash streams typically accompany glacial melting by draining downslope away from the melting ice front. These sediment choked streams leave sorted channel, delta, and floodplain deposits. Once the glacial ice is gone, the stark landscape is devoid of any stabilizing vegetation. Strong winds often entrain dust and silt sized particles, transporting them to create loess deposits in downwind directions.

Thin glacial sand-rich till as well as sand and gravel glacial outwash deposits mantle the bedrock at Weir Farm National Historic Site. Thin loess beds may also be present at the site, but are not distinct in all cases throughout the area. Striations, or glacial grooves, created when glacial ice filled with sediment rasps over the underlying bedrock may be present in the bedrock exposures at the site. Surficial geologic mapping in the area shows ice fronts and spillways. Local valleys may reflect areas plucked of bedrock by advancing glacial ice.

Geology and History Connections

In 1882, American Impressionist painter, J. Alden Weir (1852-1919), acquired the 153-acre farm in the Branchville section of Ridgefield, Connecticut. The farm was his summer home for 37 years and provided an escape from the urban setting of New York City. Weir built a studio in Branchville, updated and enlarged the main farmhouse, and acquired more land in 1907. At its peak, the farm

totaled 238 acres. The natural beauty of the farm inspired Weir and many other artists, including Childe Hassam, John Twachtman, Emil Carlsen and Albert Pinkham Ryder. The purpose of the park is intimately tied to the landscape as an inspiration for art for Weir and his artists friends and for the generations of artists that followed. During Weir's time, there was less vegetation in the area obscuring the landforms. Most of the farm was pastureland. Several specific sites at Weir Farm National Historic Site were subjects of Weir's paintings. The underlying geology and geomorphological processes are important in the evolution of this inspiring landscape. For example, in Weir's painting called "Spring Landscape, Branchville" (copy protected: http://www.nps.gov/wefa/photosmultimedia/photogallery.htm), one of the steeper slopes in the area provided rich subject matter. At the base of the slope, a small scarp surface figures into the foreground. Another scarp may provide a hiding place for two figures in Weir's "The Truants".

Weir Farm National Historic Site contains many stone walls (figure 2). These are objects of restoration efforts by the national historic site staff. These walls are the subject of a weekly interpretive program. Understanding and incorporating the geologic history and composition of these walls and bedrock outcrops within the park into this interpretive program provides an ideal opportunity to increase an awareness of the natural features of Weir Farm National Historic Site.

Figure 2: Julian Alden Weir painting at Weir Farm beyond a stone wall. Photograph is posted on the park website: www.nps.gov/wefa

Recommendations

(1) Tap the GeoScientists-in-the-Parks program to develop an interpretive trail guide map focusing on geologic controls of landscape evolution and how the landscape inspired many works of art at Weir Farm National Historic Site.

(2) Perform aerial surveys to provide photographs to support mapping efforts at the national historic site.
(3) Use geologic maps layered with vegetation maps (available at the U.S. Geological Survey website: http://biology.usgs.gov/npsveg/states/ct.html) to determine correlations between vegetation patterns and underlying geology. The NPS has also supported large scale vegetation mapping at the national historic site under the supervision of the Connecticut DEP [reference: Barrett, Metzler, Nosal, Millinor, and Sneddon (currently in NPS review)].
(4) Study the lichen on stone walls at Weir Farm to determine timing of construction.
(5) Consult GRD's paleontological inventory for the Northeast Temperate Network (in progress: http://www2.nature.nps.gov/geology/paleontology/publications.cfm)
(6) Develop a map showing points where artworks were created in situ to allow visitors to understand the natural setting that artists found inspirational.

Action Items

(1) GRE staff will use the following website to obtain geologic information about Connecticut: http://ct.gov/dep/cwp/view.asp?a=2701&q=323434&depNav_GID=1641
(2) GRE will produce digital geologic map for the national historic site (see above geologic mapping section).
(3) GRE report author will obtain the map report from Kroll (1977) for the Norwalk North quadrangle.
(4) GRE will contact Dave Steenson (NPS-GRD) regarding remediation at the national historic site.
(5) For geochemical information, GRE report author will obtain a copy of the reference: Robinson, G.R., Kapo, K.E., 2003, *Generalized lithology and lithochemical character of near-surface bedrock in the New England region*. U.S. Geological Survey, Open-File Report OF-03-225.

References

www.nps.gov/wefa (accessed July 17, 2007)

www.topozone.com (accessed July 17, 2007)

http://biology.usgs.gov/npsveg/states/ct.html (accessed July 19, 2007)

Table 1. Scoping Meeting Participants

Name	Affiliation	Position	Phone	E-Mail
Connors, Tim	NPS – GRD	Geologist	303-969-2093	Tim_Connors@nps.gov
DeSimone, Dave	Vermont Geological Survey & DeSimone Geoscience Investigations	Geologist	518-686-4252	hawkeye272david@yahoo.com
Heise, Bruce	NPS – GRD	Geologist	303-969-2017	Bruce_heise@nps.gov
Johnson, Beth	NPS – NER	Network Coordinator	401-874-7060	Beth_johnson@nps.gov
Steinen, Randolph	State Geological and Natural History Survey of Connecticut	Geologist	860-933-2590	steinen@snet.net
Thomas, Margaret	State Geological and Natural History Survey of Connecticut	State Geologist	860-424-3583	margaret.thomas@po.state.ct.us
Thornberry-Ehrlich, Trista	Colorado State University	Geologist-Report Writer	757-416-5928	tthorn@cnr.colostate.edu
Waters, Greg	NPS – WEFA	Horticulturalist	203-544-9829, ext. 11	Greg_waters@nps.gov
Wise, Don	University of Massachusetts, Amherst	Geologist	413-253-5342	dwise@geo.umass.edu

Table 2. GRE Mapping Plan for Weir Farm National Historic Site

Should GRE use this map ?	GMAP ID	REFERENCE URL	appraisal	GRE action required	scale
maybe	2953	London, E.H., 1984, Surficial geologic map of the Bethel quadrangle, Connecticut, USGS, Miscellaneous Field Studies Map MF-1519, 1:24000 scale	2007-0808: have paper copy; not sure if it's digital GIS-based by anyone else; appears to be superseded/incorporated into GMAP 74348 (CT state surficial), but needs compared/contrasted for verification and then decide best source	digitization	24000
maybe	74791	Wintsch, Bob, 2007, Unpublished Bedrock geologic map of the Bethel 7.5' quadrangle, Connecticut, Indiana University, unpublished, 1:24000 scale	2007-0808: heard of desire of CT GS to map during WEFA GRE scoping session; Bob Wintsch says currently no funding to do the work	unknown	24000
maybe	2954	London, E.H., 1984, Surficial geologic map of the Norwalk North quadrangle, Connecticut, USGS, Miscellaneous Field Studies Map MF-1520, 1:24000 scale	2007-0808: have paper copy; not sure if it's digital GIS-based by anyone else; appears to be superseded/incorporated into GMAP 74348(CT state surficial), but needs compared/contrasted for verification and then decide best source	digitization	24000
maybe	55025	Kroll, R.L., 1969, Bedrock geology of the Norwalk north quadrangle, Connecticut (plate 1/5), Connecticut Geological and Natural History Survey, Quadrangle Report 34 (plate 1/5), 1:24000 scale	2007-0808: reference doesn't seem correct; year should be 1977. Saw hardcopy that CTGS brought to meeting; need to obtain and properly cite this with GMAP 55026. There are 4 plates in the pub. Might be superseded/incorporated into GMAP 2299 but needs compared / contrasted to know for sure and then decide whether to use or not	digitization	24000
maybe	2299	Rodgers, John, 1985, Bedrock geological map of Connecticut, Connecticut Geological and Natural History Survey, Connecticut Natural Resources Atlas Series, 1:125000 scale	2007-0808: downloaded GIS files from CT site; shows lots of detail in 2 WEFA QOI's; think we could get by with this at least for Bethel 7.5 (GMAP 74791)'; needs compared/contrasted to Norwalk North (GMAP 55025) before proceeding and then decide whether to use or not	conversion	125000
maybe	74348	Stone, J.R., Schafer, J.P., London, E.H., DiGiacomo-Cohen, M.L., Lewis, R.S., and Thompson, W.B., 2005, Quaternary geologic map of Connecticut and Long Island Sound Basin, USGS, Scientific Investigations Map SIM-2784, 1:125000 scale http://pubs.usgs.gov/sim/2005/2784/	2007-0808: should supersede GMAP 25900; gives detailed surficial for WEFA 2 QOI's; have PDF but no GIS version. Should be latest greatest that supersedes both GMAPs 2954 & 2953 because it is newest. Need to acquire GIS files from USGS and compare / contrast detail to existing 7.5's to verify before proceeding. Would crop down just to 2 WEFA qoi's	conversion	125000

[1]GMAP numbers are unique identification codes used in the GRE database.